DOCUMENT RESUME

ED 021 806 24 SP 001 545

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A STUDY IN TEACHER ATTITUDE CHANGE.

Texas Univ., Austin. Science Education Center.
Spons Agency- Office of Education (DHEW), Washington, D.C. Bureau of Research.
Report No- SIP-RR-2
Bureau No- BR-5-0249
Pub Date [67]
Contract- OEC-6-10-108
Note- 13p.
EDRS Price MF-$0.25 HC-$0.60
Descriptors- *CHANGING ATTITUDES, CURRICULUM PROBLEMS, *ELEMENTARY SCHOOL TEACHERS, *INSERVICE TEACHER EDUCATION, *SCIENCE CURRICULUM, *TEACHER ATTITUDES
Identifiers- Science--A Process Approach, Semantic Differential

Since teacher attitude is an important factor in implementing curriculum change, teacher education programs are designed to communicate the spirit and philosophy of new curriculum programs. This study attempted to determine which factors contribute most to teacher attitudinal change. Sixty elementary school teachers from 7 adjoining Texas school districts participated in a new curriculum, "Science--A Process Approach," developed by the American Association for the Advancement of Science. All 60 used the innovation in their classrooms as part of the teacher education program. To measure teachers' attitudes the Semantic Differential was used for pre- and posttesting with multi-linear regression yielding 36 criterion variables. Predictor variables used were previous course hours in science, years of teaching experience, grade level taught, and school location; each was assessed by analysis of convariance which held the other 3 constant. It was concluded that teachers' attitudes do change when they are involved in a teacher education program to increase competence in the processes of science. Results indicate that grade level is a relevant contributor to a positive change in the attitude of primary level teachers, but not for those at the intermediate level. Teachers with few or no previous course hours in science also developed more positive attitudes toward both science and their teaching. But previous teaching experience and school location appear unrelated to attitude change. Five references are cited. (JS)

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U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
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SCIENCE INSERVICE PROJECT
RESEARCH REPORT NO. 2

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Implementing curriculum change requires a careful analysis of those factors which affects its use. The importance of the attitude of teachers was described by Noda (1952) when he noted that the most important block to curriculum change arises out of the attitude of the teachers and their relationship to other teachers and principals.

To communicate the spirit and philosophy of a curriculum innovation to teachers, it has been necessary to develop a teacher education program. This program is designed to enhance the meaning of the curriculum innovation, Science - A Process Approach, which was developed by the Commission on Science Education of the American Association for the Advancement of Science. A more positive attitude of teachers toward the innovation is expected to result from the increased knowledge of the program.

The research represented herein was performed pursuant to Contract #OE 6-10-108, (Research and Development Center for Teacher Education; The University of Texas), with the Office of Education, U. S. Department of Health, Education and Welfare.

When involved in the teacher education program, (Butts, 1967, Willson, 1967) it has been observed that all teachers do not demonstrate the same degree of change. Is it because their potential for change differs? For example, some may have had a positive attitude and hence little room for modification. Or, is it because the past experience of the teacher makes change virtually impossible?

In the design of any program it is desirable to intelligently select those trainees who will probably benefit the most from the program. A previous study (Butts and Raun, 1967) was concerned with the type of teacher with whom a teacher education program can expect to produce the greatest change in perception of the innovation and practice of innovation. The study presented here directs attention toward those factors which contribute to the greatest attitudinal change in a teacher who experiences a curricular innovation which focuses on the processes of science. Attitudes have been selected for study here since they reflect perceptions maintained by individuals. These perceptions structure their behavior. They represent a key criterion for change or improvement.

Is the amount of change in attitude governed by such factors as: previous knowledge of science; relevance of previous teaching experience; relevance of the teacher education program to the grade level taught and; relevance of the program to the school location?

PROBLEM

Recognizing that all teachers do not experience the same amount of change as a result of the teacher education program, what factors contribute to the greatest attitudinal change? Using this change in attitude as a criteria, what contributions are made by a teacher's previous knowledge in science, previous teaching experience, and perception of relevance of the program to the grade level taught of to the school location?

DESIGN

In the design of this study all of the participants were involved in the same curriculum program, Science - A Process Approach. In addition, they used this innovation in their classroom as part of the teacher education program. The variables for study were school, grade level, previous teaching experience, and previous course work in science.

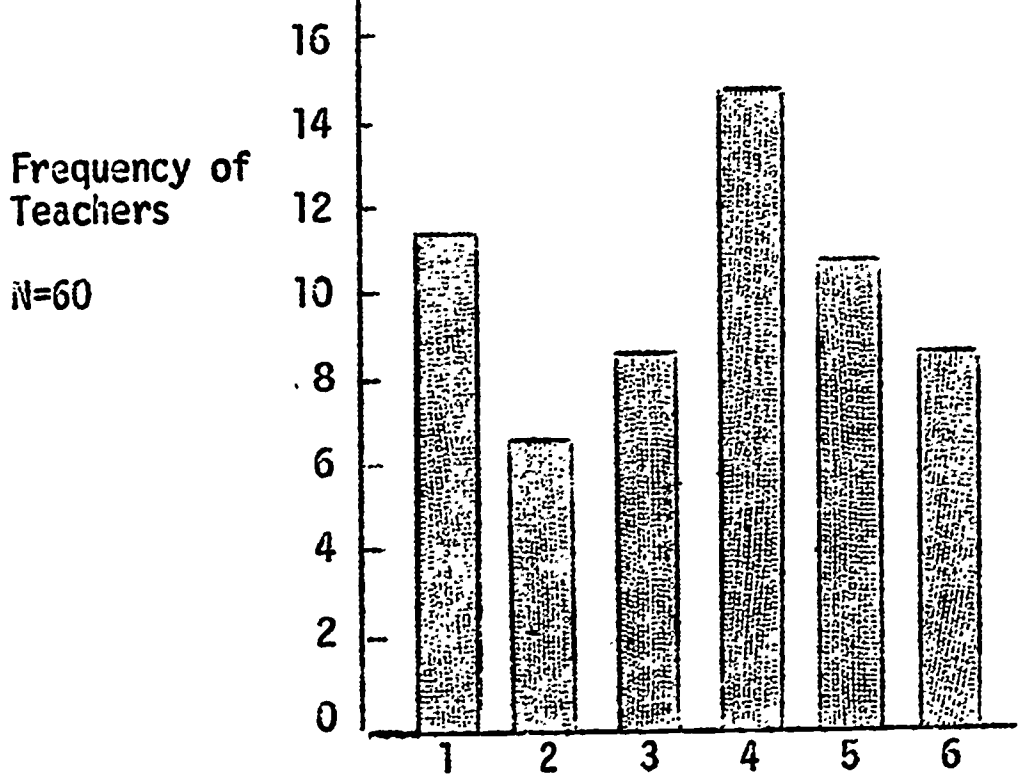
The 60 teachers in the sample came from the Austin Independent School District and seven adjoining school districts. Teaching experience ranged from 0 to 34 years with a median of 7.75 years. Their course work in science varied from 0 to 30 hours with a median of 11.5 hours. Grade level distribution is found in Table 1.

INSTRUMENTATION

To measure the teacher's attitude the Semantic Differential was used. The instrument is composed of twelve stimulus, or protocol

TABLE 1

DISTRIBUTION OF TEACHERS BY
GRADE LEVEL



words, each accompanied by the same twelve pairs of polar words. Responses are indicated on a seven point scale between polar pairs. Scores are expressed in terms of the factors of evaluation, potency, and activity. The Semantic Differential was administered as a pre-test before the subjects participated in the teacher education program. Following the completion of the program the post-test was administered.

ANALYSIS

Multi-linear regression was used with the Semantic Differential, yielding 36 criterion variables. Previous course hours in science, years of teaching experience, grade level taught, and school were used as the predicting variables. Each of the predictor variables was assessed by analysis of covariance which held the other three variables constant.

FINDINGS

1. Is teacher-attitude change related to the school location? From an analysis of the data of this study there is no evidence that school location is a significant contributor to attitude change. This is true beyond any relation to years of teaching experience, hours of previous science courses, or grade level taught.

2. Is teacher-attitude change related to the grade level taught? Analysis of the data indicates that only for the Semantic Differential criterion of the evaluation of teaching is there a relationship to grade taught. (Table 2) It appears that teachers of grades

TABLE 2

EVALUATION OF TEACHING BY GRADE LEVEL TAUGHT
N=60

Semantic Differential	Grade 1 N=12	Grade 2 N=7	Grade 3 N=8	Grade 4 N=14	Grade 5 N=11	Grade 6 N=8	Probability Level
Protocol Factor	B Weight	B Weight	B Weight	B Weight	B Weight	B Weight	
Teaching Evaluation	1.4244	2.9476	-5.1441	-0.5489	0.3654	-0.4432	<.05

one and two place a greater value on their teaching as a result of the curriculum programs. Teachers of grade five show a slight increase in their value of teaching while teachers of grades three, four and six tend to experience a decrease in the value of teaching with grade three teachers showing the greatest descrease.

3. Is teacher-attitude change related to previous teaching experience? From an analysis of the data of this study there is no evidence to indicate that previous teaching experience is a significant contributor to attitude change. This is true beyond any relation to previous course hours in science, grade level taught, or school.

4. Is teacher-attitude change related to previous course hours in science? Analysis of the data (Table 3) indicates:

(a) that a greater number of previous course hours in science results in significant but negative relations of how a teacher perceives the impact of these hours of science on the area of science, on her teaching, and on her reaction to the curricular program of Science - A Process Approach.

(b) that a greater number of previous course hours in science results in a significant increase in the value a teacher places on the use of the library and the principal's view of Science - A Process Approach

TABLE 3

RELATION OF SOME PROTOCOLS OF THE SEMANTIC DIFFERENTIAL AND HOURS OF SCIENCE COURSES

N=60

SEMANTIC DIFFERENTIAL		HOURS SCIENCE COURSES	
Protocol	Factor	B Weight	Probability Level
Science	Potency	-.3500	<.01
Teaching	Potency	-.2989	<.03
Science - A Process Approach	Potency	-.3027	<.02
Library	Evaluation	.3787	<.02
Principal's View of Science A Process Approach	Evaluation	.2756	<.02

CONCLUSIONS

Teachers' attitudes do change when involved in the teacher education program which is directed towards an increased competence in the processes of science. Although a significant change in only one of the thirty-six criterion variables and its relation to grade level was evident, it is an important change. Primary level teachers, grades one and two, indicat' a very positive change in how they value teaching while those of the intermediate level show little positive change or they exhibit a negative attitude toward the value of teaching. One may infer from this attitudinal change toward teaching that the role of the teacher is more clearly defined or relevant at the primary level but is not at the intermediate level. This may further suggest that the teacher education program, though effective for one level, is not effective at the other level. Whether this is a result of program instruction or program materials is not clear.

A teacher's change in attitude when involved in the teacher education program also appears to be related to previous course work in science. One may infer from the results of the study that a teacher who has had few or no formal courses in science will have a more positive attitude toward the impact of science, the impact of her teaching, and the impact of the processes of science. This same teacher will not appear to value the library as a place of learning science nor will she be as concerned about the value her principal may place on the

curriculum innovation as her sister teacher with a larger number of previous science courses will tend to do.

Change in attitude does not appear to be related to years of teaching experience. Since there was a wide range of teaching experience represented and since there were no systematic trends observed, either the program is not clearly related to what a teacher expects and how she handles student responses or else teachers with more experience would not benefit equally well from all the programs.

Attitude change does not appear to be related to the school at which the teacher is teaching. Interpreting this finding requires caution. It could be inferred that the school setting does not contribute to attitude change. However, further study of this sample would reveal that these teachers were included in an experimental program to which their administrator had made a specific commitment. In each case the administrator also participated in the series of orientation conferences with regard to the curriculum innovation. The effect of this part of the program may well have served to limit the effect of whatever contribution a school might make to attitude change.

SUMMARY

Recognizing that all teachers did not experience the same amount of change as a result of the teacher education program, what are the factors which contribute to the greatest attitudinal change?

Results of this study indicate that grade level is a relevant contributor to a positive change in the attitude of primary level

teachers but not for those teaching at the intermediate level. Previous course hours in science is also a relevant contributor to more positive attitude for those teachers who have few or no previous hours of science. Previous teaching experience and the location of the school where the teacher teaches do not appear to be relevant contributors to attitude change.

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